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Qian et al.

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(54) **ACTIVATING A MOBILE TERMINAL FROM MOBILE NETWORK SIDE**

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H04W 8/26	(2009.01)
H04L 29/06	(2006.01)
H04W 8/24	(2009.01)

(52) **U.S. Cl.**

CPC ***H04W 8/22*** (2013.01); ***H04L 51/04*** (2013.01); ***H04L 65/1073*** (2013.01); ***H04W 8/265*** (2013.01); *H04L 51/38* (2013.01); *H04W 8/245* (2013.01)

(58) **Field of Classification Search**

CPC H04W 8/22; H04W 8/265; H04L 51/04; H04L 65/1073

USPC 370/252, 329, 310.2, 328, 338, 331, 370/395.4; 455/436

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

7,408,948	B2 *	8/2008	Lopponen et al.	370/433
7,715,868	B2	5/2010	Zhao et al.	
7,724,711	B2 *	5/2010	Haumont	370/338
7,774,007	B2	8/2010	Backholm et al.	
7,904,101	B2	3/2011	Backholm	

(Continued)

OTHER PUBLICATIONS

Henry Haverinen et al., "Energy Consumption of Always-On Applications in WCDMA Networks," IEEE, 2007.

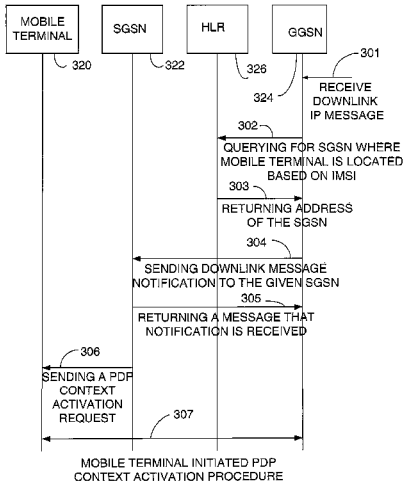
Primary Examiner — Warner Wong

(74) *Attorney, Agent, or Firm* — Roy W. Truelson; James R. Nock

(57) **ABSTRACT**

Disclosed is a method of activating a mobile terminal from mobile network side and a mobile application gateway system. The method comprises: receiving, by a mobile application gateway, a request for activating the mobile terminal, the request including an unique identification number of the mobile terminal; querying, by the mobile application gateway, a HLR for address of a SGSN where the mobile terminal is located; returning, by the HLR, the queried address of SGSN to the mobile application gateway; sending, by the mobile application gateway, the request for activating the mobile terminal to the SGSN; issuing, by the SGSN, a request to the mobile terminal, requiring the mobile terminal to issue a mobile terminal initiated PDP context activation request. The method enables an instant messaging user at a mobile terminal to automatically open an IP connection if there is any message to be received after the IP connection is closed.

8 Claims, 8 Drawing Sheets



(56) **References Cited**

U.S. PATENT DOCUMENTS

2002/0150092	A1*	10/2002	Bontempi et al.	370/389
2003/0002480	A1*	1/2003	Giustina et al.	370/352
2004/0148425	A1*	7/2004	Haumont et al.	709/236
2004/0228347	A1*	11/2004	Hurtta et al.	370/395.2
2004/0259532	A1*	12/2004	Isomaki et al.	455/412.1
2005/0249238	A1*	11/2005	Haumont	370/466
2006/0023663	A1*	2/2006	Kim et al.	370/329
2007/0053326	A1*	3/2007	Ala-Luukko	370/335
2007/0165645	A1*	7/2007	Zhang et al.	370/395.2
2008/0059582	A1	3/2008	Hartikainen et al.	
2009/0170512	A1	7/2009	Regnier et al.	
2010/0214924	A1	8/2010	Sendra Alcina et al.	
2011/0070906	A1*	3/2011	Chami et al.	455/507
2012/0129517	A1*	5/2012	Fox et al.	455/425
2013/0188549	A1*	7/2013	Busropan et al.	370/312

* cited by examiner

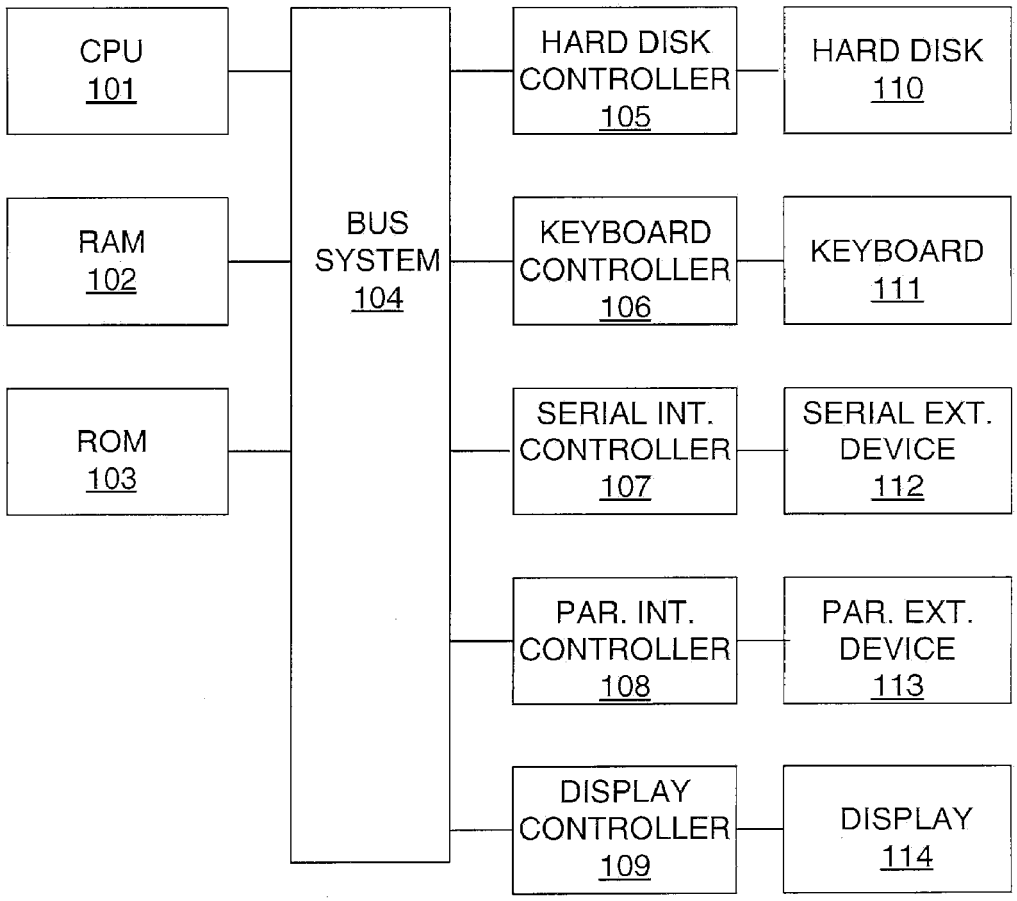

CPU
101
RAM
102
ROM
103
BUS
SYSTEM
104
HARD DISK
CONTROLLER
105
KEYBOARD
CONTROLLER
106
SERIAL INT.
CONTROLLER
107
PAR. INT.
CONTROLLER
108
DISPLAY
CONTROLLER
109
HARD DISK
110
KEYBOARD
111
SERIAL EXT.
DEVICE
112
PAR. EXT.
DEVICE
113
DISPLAY
114

FIG. 1

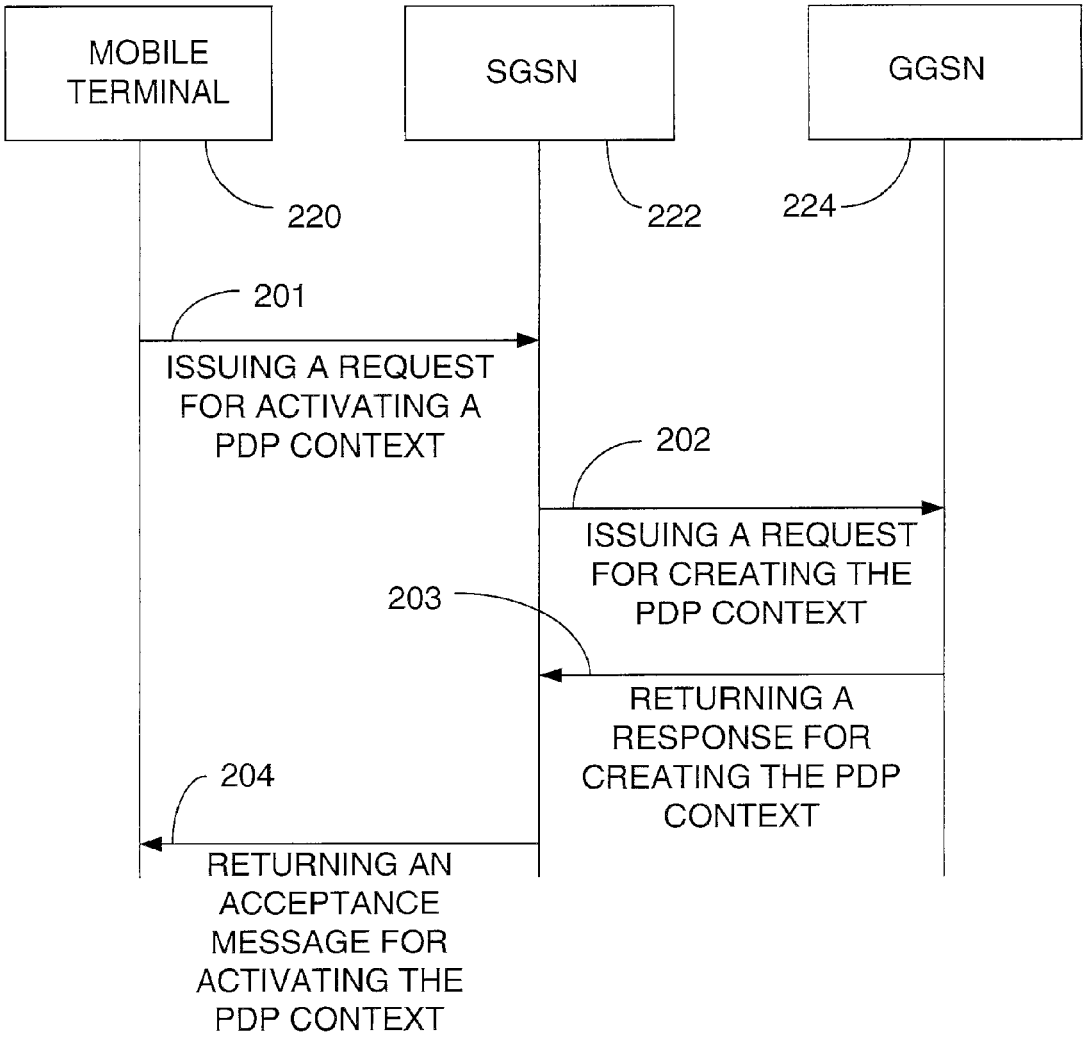
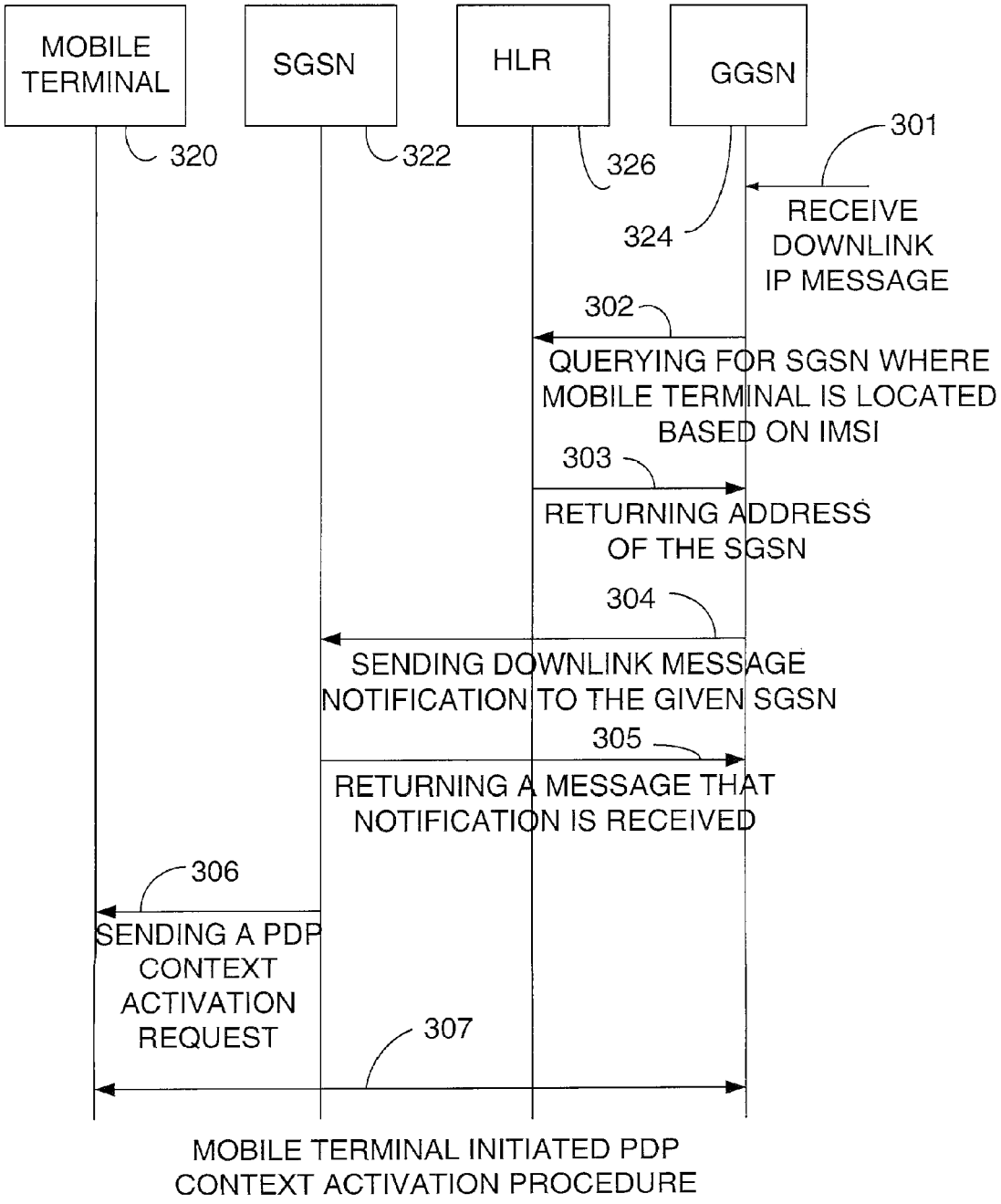

MOBILE TERMINAL
SGSN
GGSN
220
222
224
201
ISSUING A REQUEST FOR ACTIVATING A PDP CONTEXT
202
ISSUING A REQUEST FOR CREATING THE PDP CONTEXT
203
RETURNING A RESPONSE FOR CREATING THE PDP CONTEXT
204
RETURNING AN ACCEPTANCE MESSAGE FOR ACTIVATING THE PDP CONTEXT

FIG. 2



MOBILE TERMINAL INITIATED PDP CONTEXT ACTIVATION PROCEDURE

FIG. 3

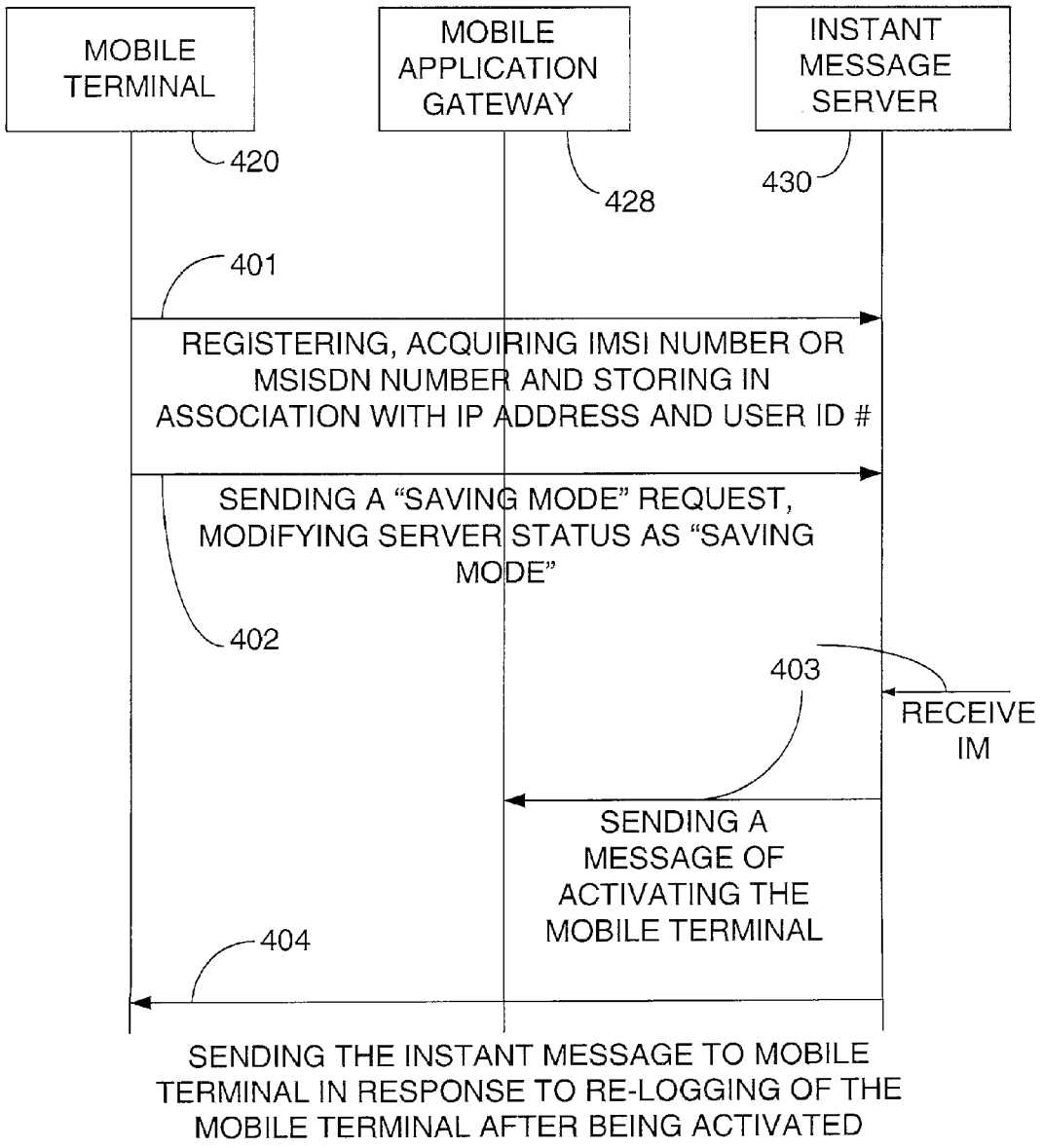
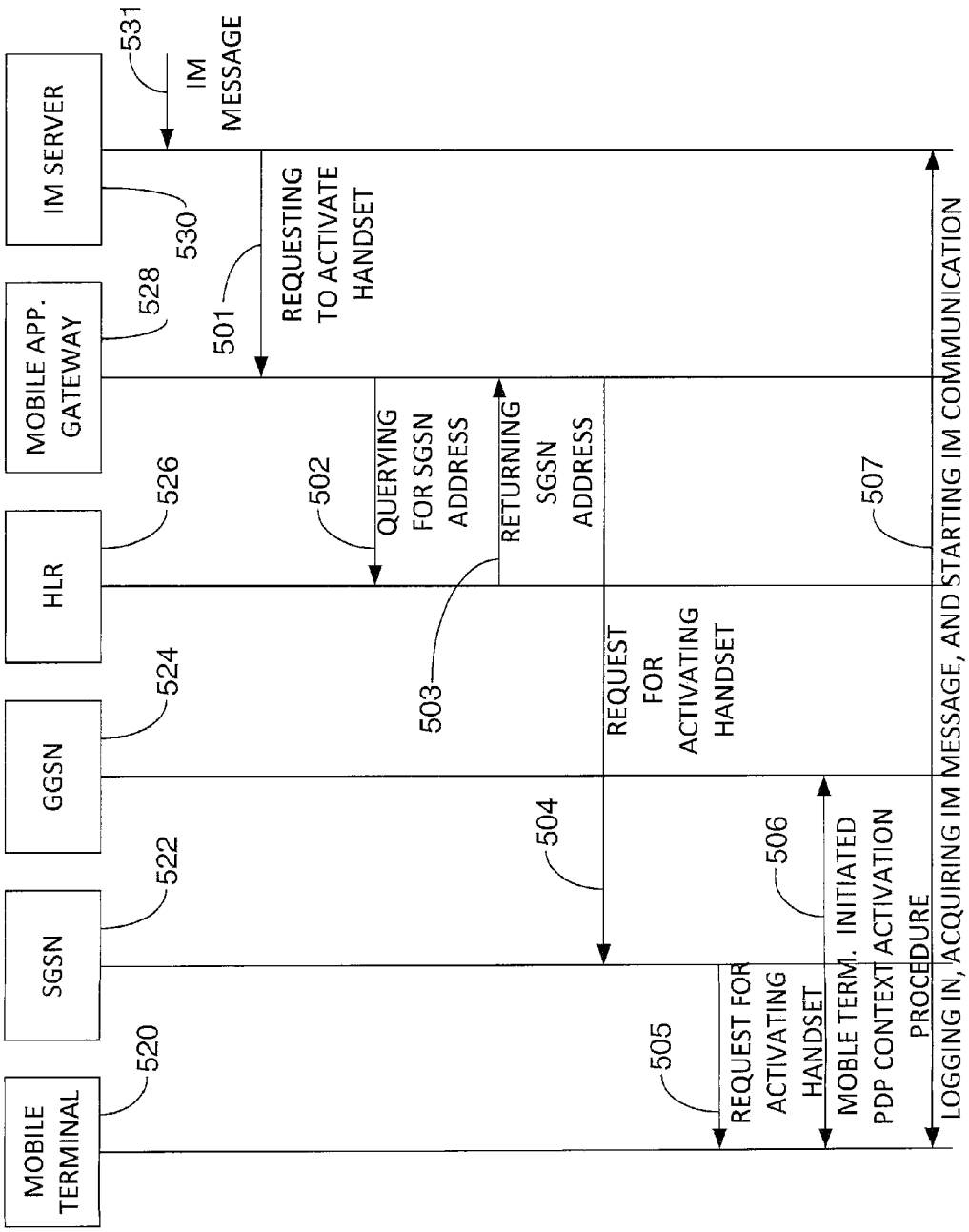

MOBILE TERMINAL
MOBILE APPLICATION GATEWAY
INSTANT MESSAGE SERVER
420
428
430
401
REGISTERING, ACQUIRING IMSI NUMBER OR MSISDN NUMBER AND STORING IN ASSOCIATION WITH IP ADDRESS AND USER ID #
SENDING A "SAVING MODE" REQUEST, MODIFYING SERVER STATUS AS "SAVING MODE"
402
403
RECEIVE IM
SENDING A MESSAGE OF ACTIVATING THE MOBILE TERMINAL
404
SENDING THE INSTANT MESSAGE TO MOBILE TERMINAL IN RESPONSE TO RE-LOGGING OF THE MOBILE TERMINAL AFTER BEING ACTIVATED

FIG. 4

FIG. 5


MOBILE TERMINAL
520
SGSN
522
GGSN
524
HLR
526
MOBILE APP. GATEWAY
528
IM SERVER
530
531
IM MESSAGE
501
REQUESTING TO ACTIVATE HANDSET
502
QUERYING FOR SGSN ADDRESS
503
RETURNING SGSN ADDRESS
504
REQUEST FOR ACTIVATING HANDSET
505
REQUEST FOR ACTIVATING HANDSET
506
MOBLE TERM. INITIATED PDP CONTEXT ACTIVATION PROCEDURE
507
LOGGING IN, ACQUIRING IM MESSAGE, AND STARTING IM COMMUNICATION

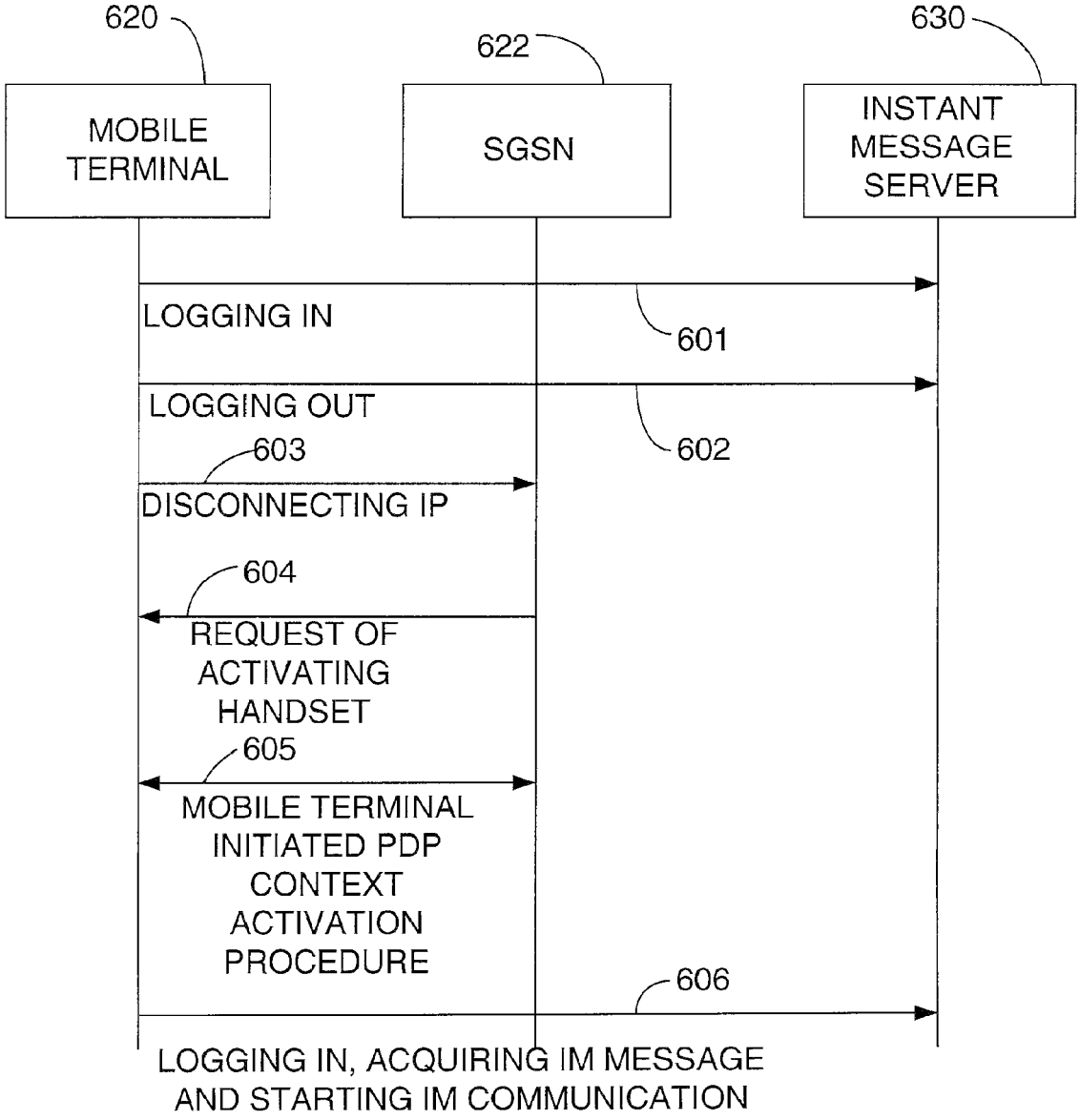

620
622
630
MOBILE TERMINAL
SGSN
INSTANT MESSAGE SERVER
LOGGING IN
601
LOGGING OUT
602
603
DISCONNECTING IP
604
REQUEST OF ACTIVATING HANDSET
605
MOBILE TERMINAL INITIATED PDP CONTEXT ACTIVATION PROCEDURE
606
LOGGING IN, ACQUIRING IM MESSAGE AND STARTING IM COMMUNICATION

FIG. 6

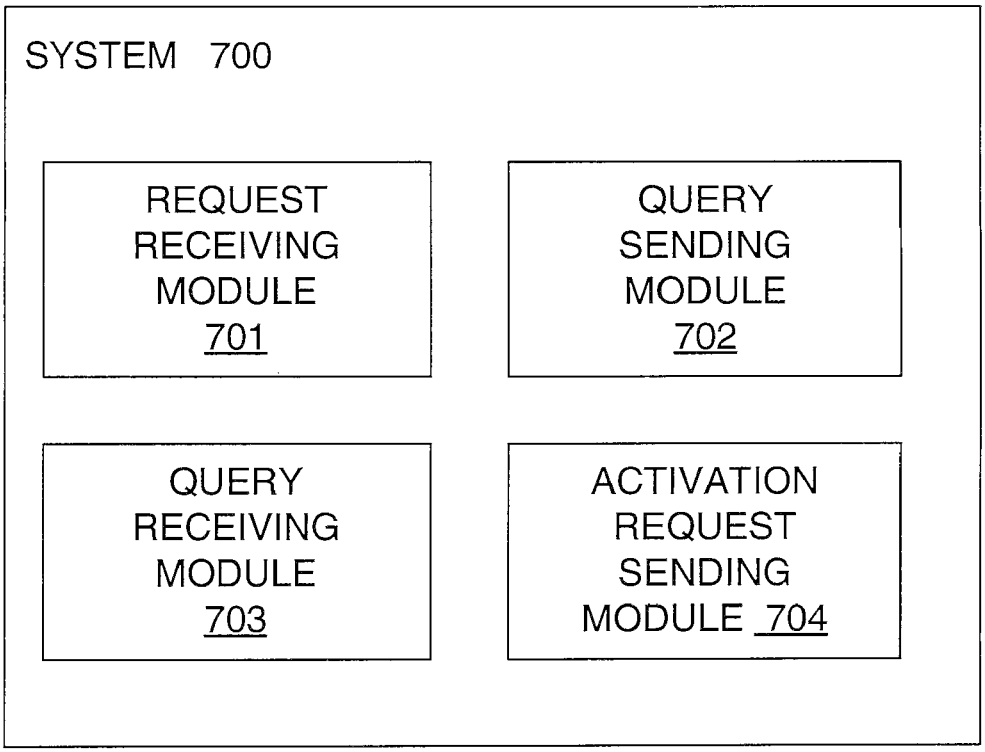

SYSTEM 700
REQUEST RECEIVING MODULE 701
QUERY SENDING MODULE 702
QUERY RECEIVING MODULE 703
ACTIVATION REQUEST SENDING MODULE 704

FIG. 7

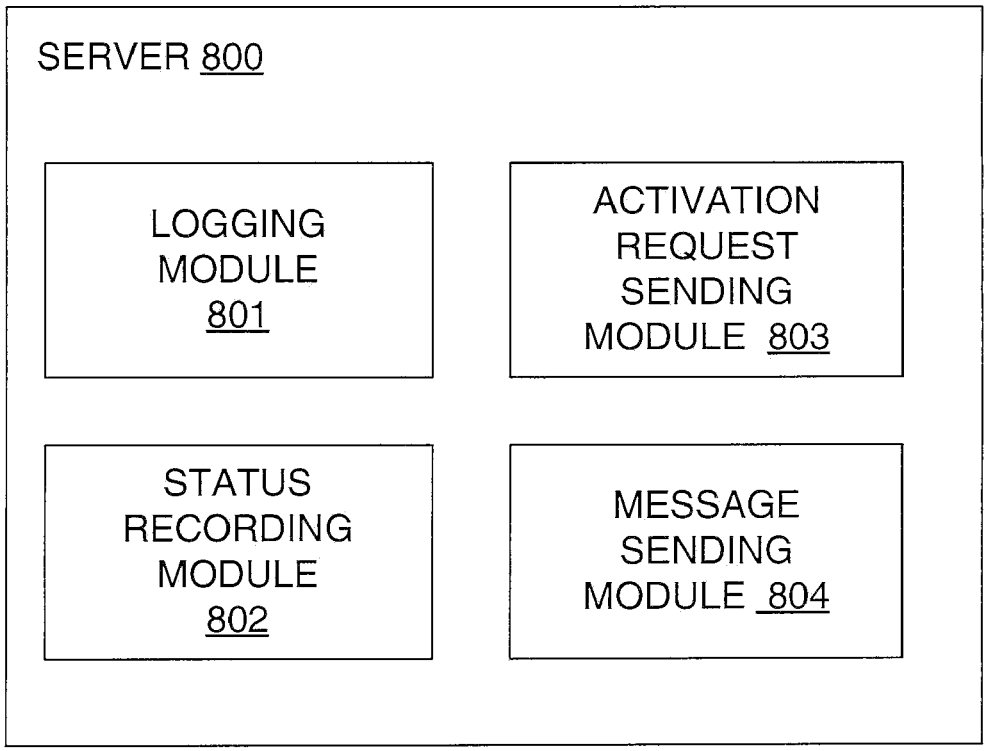

SERVER 800
LOGGING MODULE 801
ACTIVATION REQUEST SENDING MODULE 803
STATUS RECORDING MODULE 802
MESSAGE SENDING MODULE 804

FIG. 8

ACTIVATING A MOBILE TERMINAL FROM MOBILE NETWORK SIDE

TECHNICAL FIELD

The present invention relates to instant message service in a mobile network, and more specifically, to a method of activating a mobile terminal from mobile network side and a mobile gateway system.

BACKGROUND

Nowadays, a variety of so-called "always online" application programs such as instant message (IM), etc., have been widely used by mobile users to acquire information at anytime and anywhere, so as to keep real-time communication with other mobile users. To remain online all the time, a mobile device has to keep constant IP connectivity via wireless data service, which is expensive and power-consuming from user's perspective, and waste of bandwidth, IP addresses and other resources from wireless operator's perspective. To save money, power and resources, an IM client can offline itself automatically after the user is inactive for a certain period of time, and close the IP connectivity, but the user will be unreachable and lose the benefit of real-time communication brought by instant messaging.

Thus, a solution is needed that enables a user of instant message of a mobile terminal to automatically open an IP connection when there is an instant message to be received after the IP connection is closed.

SUMMARY

In order to solve problems existing in the art, by modifying operation at mobile network side, user of instant message of a mobile terminal is enabled to automatically open IP connection when there is an instant message to be received after the IP connection is closed.

According to an aspect of the present invention, there is provided a method of activating a mobile terminal from mobile network side, comprising:

receiving, by a mobile application gateway, a request for activating the mobile terminal, the mobile terminal having no IP connection, the request includes an unique identification number of the mobile terminal;

querying, by the mobile application gateway, a Home Location Register (HLR) for address of a Servicing GPRS Supporting Node (SGSN) where the mobile terminal is located by utilizing the unique identification number of the mobile terminal;

returning, by the HLR, the queried address of SGSN to the mobile application gateway;

sending, by the mobile application gateway, the request for activating the mobile terminal to the SGSN; and

issuing, by the SGSN, a request to the mobile terminal, requiring the mobile terminal to issue a request for activating a Packet Data Protocol (PDP) context to the SGSN.

According to another aspect of the present invention, there is provided a mobile application gateway system, comprising:

a request receiving module configured to receive a request for activating a mobile terminal, the request includes an unique identification number of the mobile terminal;

a query sending module configured to query a Home Location Register (HLR) for an address of a Servicing GPRS Supporting Node (SGSN) where the mobile terminal is located by utilizing the unique identification number of the mobile terminal;

a query receiving module configured to receive address of the Servicing GPRS Supporting Node (SGSN) queried by the HLR; and

an activation request sending module configured to send the request for activating the mobile terminal to the SGSN.

According to still another aspect of the present invention, there is provided a method of using an instant message server, comprising:

storing an unique identification number of a mobile terminal in response to login of an instant message client running on the mobile terminal;

modifying status of the instant message client as "saving mode" in response to receiving a request for transferring status of the instant message client into "saving mode"; and

sending a request for activating the mobile terminal to a mobile application gateway in response to receiving an instant message sent to the instant message client whose status is "saving mode", the request includes the unique identification number of the mobile terminal.

According to yet another aspect of the present invention, there is provided an instant message server, comprising:

a logging module configured to store an unique identification number of a mobile terminal in response to receiving login of an instant message client running on the mobile terminal;

a status recording module configured to modify status of the instant message client as "saving mode" in response to receiving a request for transferring status of the instant message client into "saving mode"; and

an activation request sending module configured to send a request for activating the mobile terminal to a mobile application gateway in response to receiving an instant message sent to the instant message client whose status is "saving mode", the request includes the unique identification number of the mobile terminal.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

Through the more detailed description of some embodiments of the present disclosure in the accompanying drawings, the above and other features and advantages of the present disclosure will become more apparent, wherein the same reference generally refers to the same components in the embodiments of the present disclosure.

FIG. **1** shows a diagram of an exemplary computer system **100** which is applicable to implement the embodiments of the present invention;

FIG. **2** shows a flow diagram of mobile terminal initiated PDP context activation;

FIG. **3** shows a diagram of current network side initiated PDP context activation procedure;

FIG. **4** shows a diagram of a flow at instant message server side of a mobile terminal version instant message application;

FIG. **5** shows a flow diagram of an improved network side initiated PDP context activation procedure according to the present invention;

FIG. **6** shows a workflow diagram corresponding to the mobile terminal;

FIG. **7** shows a structural block diagram of the mobile application gateway system; and

FIG. **8** shows a structural block diagram of the instant message server.

DETAILED DESCRIPTION

Some embodiments will be described in more detail with reference to the accompanying drawings, in which the embodiments of the present disclosure have been illustrated. However, the present disclosure can be implemented in various manners, and thus should not be construed to be limited to the embodiments disclosed herein. On the contrary, those embodiments are provided for the thorough and complete understanding of the present disclosure, and completely conveying the scope of the present disclosure to those skilled in the art.

FIG. **1** shows an exemplary computer system **100** which is applicable to implement the embodiments of the present invention. As shown in FIG. **1**, the computer system **100** may include: CPU (Central Process Unit) **101**, RAM (Random Access Memory) **102**, ROM (Read Only Memory) **103**, System Bus **104**, Hard Drive Controller **105**, Keyboard Controller **106**, Serial Interface Controller **107**, Parallel Interface Controller **108**, Display Controller **109**, Hard Drive **110**, Keyboard **111**, Serial Peripheral Equipment **112**, Parallel Peripheral Equipment **113**, and Display **114**. Among above devices, CPU **101**, RAM **102**, ROM **103**, Hard Drive Controller **105**, Keyboard Controller **106**, Serial Interface Controller **107**, Parallel Interface Controller **108** and Display Controller **109** are coupled to the System Bus **104**. Hard Drive **110** is coupled to Hard Drive Controller **105**. Keyboard **111** is coupled to Keyboard Controller **106**. Serial Peripheral Equipment **112** is coupled to Serial Interface Controller **107**. Parallel Peripheral Equipment **113** is coupled to Parallel Interface Controller **108**. And, Display **114** is coupled to Display Controller **109**. It should be understood that the structure as shown in FIG. **1** is only for the exemplary purpose rather than any limitation to the present invention. In some cases, some devices may be added to or removed from the computer system **100** based on specific situations.

As will be appreciated by one skilled in the art, aspects of the present invention may be embodied as a system, method or computer program product. Accordingly, aspects of the present invention may take the form of an entirely hardware embodiment, an entirely software embodiment (including firmware, resident software, micro-code, etc.) or an embodiment combining software and hardware aspects that may all generally be referred to herein as a "circuit," "module" or "system." Furthermore, aspects of the present invention may take the form of a computer program product embodied in one or more computer readable medium(s) having computer readable program code embodied thereon.

Any combination of one or more computer readable medium(s) may be utilized. The computer readable medium may be a computer readable signal medium or a computer readable storage medium. A computer readable storage medium may be, for example, but not limited to, an electronic, magnetic, optical, electromagnetic, infrared, or semiconductor system, apparatus, or device, or any suitable combination of the foregoing. More specific examples (a non-exhaustive list) of the computer readable storage medium would include the following: an electrical connection having one or more wires, a portable computer diskette, a hard disk, a random access memory (RAM), a read-only memory (ROM), an erasable programmable read-only memory (EPROM or Flash memory), an optical fiber, a portable compact disc read-only memory (CD-ROM), an optical storage device, a magnetic storage device, or any suitable combination of the foregoing. In the context of this document, a computer readable storage medium may be any tangible medium that can contain, or store a program for use by or in connection with an instruction execution system, apparatus, or device.

A computer readable signal medium may include a propagated data signal with computer readable program code embodied therein, for example, in baseband or as part of a carrier wave. Such a propagated signal may take any of a variety of forms, including, but not limited to, electro-magnetic, optical, or any suitable combination thereof. A computer readable signal medium may be any computer readable medium that is not a computer readable storage medium and that can communicate, propagate, or transport a program for use by or in connection with an instruction execution system, apparatus, or device.

Program code embodied on a computer readable medium may be transmitted using any appropriate medium, including but not limited to wireless, wireline, optical fiber cable, RF, etc., or any suitable combination of the foregoing.

Computer program code for carrying out operations for aspects of the present invention may be written in any combination of one or more programming languages, including an object oriented programming language such as Java, Smalltalk, C++ or the like and conventional procedural programming languages, such as the "C" programming language or similar programming languages. The program code may execute entirely on the user's computer, partly on the user's computer, as a stand-alone software package, partly on the user's computer and partly on a remote computer or entirely on the remote computer or server. In the latter scenario, the remote computer may be connected to the user's computer through any type of network, including a local area network (LAN) or a wide area network (WAN), or the connection may be made to an external computer (for example, through the Internet using an Internet Service Provider).

Aspects of the present invention are described below with reference to flowchart illustrations and/or block diagrams of methods, apparatus (systems), and computer program products according to embodiments of the invention. It will be understood that each block of the flowchart illustrations and/or block diagrams, and combinations of blocks in the flowchart illustrations and/or block diagrams, can be implemented by computer program instructions. These computer program instructions may be provided to a processor of a general purpose computer, special purpose computer, or other programmable data processing apparatus to produce a machine, such that the instructions, which execute via the processor of the computer or other programmable data processing apparatus, create means for implementing the functions/acts specified in the flowchart and/or block diagram block or blocks.

These computer program instructions may also be stored in a computer readable medium that can direct a computer, other programmable data processing apparatus, or other devices to function in a particular manner, such that the instructions stored in the computer readable medium produce an article of manufacture including instructions which implement the function/act specified in the flowchart and/or block diagram block or blocks.

The computer program instructions may also be loaded onto a computer, other programmable data processing apparatus, or other devices to cause a series of operational steps to be performed on the computer, other programmable apparatus or other devices to produce a computer implemented process such that the instructions which execute on the computer or other programmable apparatus provide processes for

implementing the functions/acts specified in the flowchart and/or block diagram block or blocks.

Generally, various so-called "always online" application programs running on a mobile terminal each keeps a TCP/IP connection with its server, they frequently interact with the servers and consume a significant amount of bandwidth and power.

To solve this problem, current intelligent pushing platforms of various popular mobile terminal operating systems have proposed to uniformly maintain one IP connection at the mobile terminal, so as to be collectively used by the mobile terminal in accessing all the application programs. A mobile terminal manufacturer or operating system manufacturer establishes a dedicated server responsible for completing pushing tasks, and a third party application server just needs to send a pushing request to a pushing server. At mobile terminal side, the mobile terminal constantly communicates with the pushing server by keeping a fixed IP address therewith and monitors an agreed port. After a server message is pushed to the mobile terminal, the mobile terminal assigns it to a corresponding application program for processing. When the pushed information arrives, the terminal will prompt the user to open the application program even if the corresponding application program is in closed state, and the information will be received after the application program is opened. Its flow will be described below by taking a mobile terminal accessing an instant message application program for example:

1. When a user logs in a push version instant message application program on a mobile terminal, the instant message application program client will send a device token of that mobile terminal and a user's instant message ID to an instant message server.
2. When there is a new message, the push version instant message server examines target instant message user ID in that message and queries for device token of the corresponding target terminal, then sends the device token together with the message to a pushing server established by the manufacturer of the mobile terminal.
3. After the pushing server established by the manufacturer of the mobile terminal receives the new message, it finds current IP address of the mobile terminal based on the device token. If the mobile terminal has no IP connection, or even it is not powered on at all, then the pushing server stores the new message, and pushes the message when the mobile terminal is online; if the mobile terminal is online, then the message is pushed immediately.

In the above steps, a mobile network provides an IP connection between the mobile terminal and the pushing server, the mobile terminal needs to keep that IP connection all the time in order to realize real-time message pushing, which not only consumes power of the mobile terminal, but also occupies IP address of the mobile network, thereby causing waste in resources.

Another solution is to release IP connection when a mobile terminal is inactive to save network resource. When a mobile network receives an instant message sent to an offline user, the mobile network sends it to the user by using a short message; the user may open an IP connection after he/she sees the short message, log into the instant message server, and then may start instant message communication. Such short-message-notification solution needs user to manually click and open an IP connection, and length of content bearable by a short message is limited. A solution in which an IP connection is opened automatically after a short message is received needs the mobile terminal to monitor all incoming short messages, and a message is regarded as a notification short message if content or originating number thereof is special, such that an IP connection is automatically opened. This behavior is not standard and is very inconvenient in case there is a need to modify originating number; furthermore, special consideration needs to be taken in security configuration.

It is contemplated in the present invention that, if a mobile terminal has no instant message communication for a long period of time and also there is no other network application program that is currently running, GPRS service of that mobile terminal may be closed and IP network connection may be disconnected; hereafter, when the instant message server receives a message for that instant message client, it will notify the mobile network to wake up that mobile terminal through an interface provided by the mobile network, so as to make that mobile terminal automatically re-establish network connection and automatically log into the instant message server, thus obtaining the sent message and performing further instant message communication. As compared to the short-message-notification solution in prior art, the present invention is to make modification at network side. The mobile terminal simply realizes an inverse activation flow according to standard. This is much easier than deploying an application program on all the mobile terminals, and the invention is so-called "installed once, runs everywhere".

The mobile network mentioned above may be a GPRS network or a 3G network. Since a GPRS network and a 3G network may share a same packet domain core network, the present invention only involves operation on packet domain core network, thus the two are collectively referred to as packet domain core network, and the invention does not distinguish between access technologies.

General Packet Radio Servicing (GPRS) is a packet data carrier service. It provides with a mobile terminal capability of accessing an external packet network (such as Internet) through a mobile network. It is designed to be wireless access technology independent, and a common packet domain core network may provide GPRS service for both 2.5G (GERAN) and 3G (UTRAN) wireless access network. A packet domain core network comprises functional entities such as Serving GPRS Supporting Node (SGSN) and Gateway GPRS Supporting Node (GGSN) etc.

First, basic concepts in wireless network technical field need to be learned in realizing the invention will be introduced below.

Open Service Access (OSA):

OSA defines an architecture that enables operator and third party application provider to make use of functionality offered by a mobile network through an open standardized interface; i.e., the OSA APIs and Parlay X web Services. Network functionality offered to applications is defined in terms of a set of Service Capability Features (SCFs), these SCFs provide an interface for network capabilities, which is accessible to applications through the OSA interface for various service development. OSA is defined in 3GPP TS 23.198. In a mobile network, these interfaces are typically packaged by a mobile application gateway (also referred to as OSA application gateway), to provide Web Service or API calling interface for an external application program.

Home Location Register (HLR):

HLR is the master database of a user. It is responsible for storing subscription data of its managed user and location information of mobile user, for example, user identity, number, address information, user profile, user location information at inter-system level, etc., such that call for a mobile terminal can be established. The HLR integrates Home Location Register and Authentication Central together and provides functions such as location change roaming manage-

ment, authentication, calling, etc.; HLR also supports rich supplementary services such as call forwarding, call barring, calling number displaying and limiting, short message and so on. The HLR provides an interface which can be used to query for current SGSN address of a certain mobile user. After receiving a query, the HLR will return address of the SGSN where that mobile terminal is located.

Serving GPRS Supporting Node (SGSN):

It forwards messages issued or received by a mobile terminal within a geographical range for which the SGSN is responsible. SGSN's task comprises packet routing and transporting, mobility management, logical link management, identity authentication and billing function. A location register module of SGSN stores location information and user profile of all GPRS users registered within current SGSN, such as IMSI number of a mobile terminal (International Mobile Subscriber Identification Number, which is a mark to distinguish between mobile users and is stored in SIM card, can be used to distinguish valid information of a mobile user), address used in a data network etc. The SGSN provides an interface which can be used by HLR or OSA application gateway to request a mobile terminal to initiate PDP context activation and re-establish an IP connection. In response to that request, the SGSN will start that process.

Gateway GPRS Supporting Node (GGSN):

GGSN is a main component of the GPRS network, which is actually a gateway or a router. The GGSN is responsible for the interworking between the GPRS network and external packet switched networks. From an external packet switched networks point of view, the GGSN is a router to a sub-network, because the GGSN 'hides' the GPRS infrastructure from the external packet switched network. On the other hand, the GGSN is responsible for routing packets originated from a mobile terminal to the right network. The GGSN enables user of a mobile terminal to keep network connection during roaming.

The Packet Data Protocol (PDP) Context:

The PDP context is a data structure used in SGSN and GGSN, in which session information of mobile user's current active session is stored. When a mobile user wants to use GPRS, he/she must first attach to the mobile network and activate a PDP context. During PDP activation, a PDP context will be allocated for user in the SGSN and GGSN currently serving that user. PDP context activation procedure is a process in which a mobile terminal acquires an IP address and establishes an IP connection.

In the present invention, the unique identification number of a mobile terminal is Mobile Subscriber ISDN number (MSISDN number, which is "mobile phone number" as commonly known) or International Mobile Subscriber Identification number (IMSI number) of that mobile terminal.

PDP context activation procedure in current GPRS wireless data service includes mobile terminal initiated PDP context activation and network side initiated PDP context activation. FIG. **2** shows a flow diagram of mobile terminal initiated PDP context activation. According to FIG. **2**,

in step **201**, receiving, by a SGSN **222**, a request for activating a PDP context issued by a mobile terminal **220**;

in step **202**, parsing out, by the SGSN, an address of a Gateway GPRS Supporting Node (GGSN) **224** of the mobile terminal based on information provided by the mobile terminal in the request for activating the PDP context, and issuing a request for creating mobile terminal PDP context to the GGSN;

in step **203**, allocating, by the GGSN, a dynamic IP address for the mobile terminal and returning a response for creating the PDP context to the SGSN;

in step **204**, receiving, by the SGSN, the response of the GGSN for creating the PDP context and sending to the mobile terminal an acceptance message of activating the PDP context.

Wherein, the acceptance message of activating the PDP context includes a dynamic IP address allocated for the mobile terminal. At this moment, a route between the mobile terminal and the GGSN has been established, that is, an IP connection has been established, and packet data transfer may be performed. During the above mobile terminal initiated PDP context activation procedure, the GGSN will allocate a dynamic IP address to the mobile terminal by default, except that the mobile terminal applies for a static address while subscription and the mobile terminal has explicitly stated that it will use static address when activating the PDP context.

The GPRS network also provides a network side PDP context activation procedure, which is a standard procedure defined in 3GPP TS 23.060 and is normally triggered by a downlink packet (that is, a packet transmitted from an external or internal switched network to a mobile client) destined to the IP address of the mobile terminal. The case under which this flow may be used can be explained through an example: if an application service is running on a mobile terminal and other user wishes to access this service, then other user needs to first send a TCP SYN to the IP address of that mobile terminal; at the GGSN, if the mobile terminal has no IP connection, this TCP SYN will trigger an inverse activation to activate the mobile terminal, that is, network side initiated PDP context activation. In practice, network side initiated PDP context activation procedure is rarely used, this is mainly because network side initiated PDP context activation procedure needs a mobile terminal to use a static IP address, however, in reality, mobile operator usually will not sell a static IP address to a mobile terminal and a user will also not buy a static IP address for mobile terminal.

FIG. **3** shows a diagram of current network side initiated PDP context activation procedure,

in step **301**, receiving, by a GGSN **324**, a downlink IP packet, IP address of destination of the packet corresponds a static IP address of a mobile terminal **320**. In this process, if the GGSN **324** is regarded as a last hop router, then all IP packets need to be sent to the mobile terminal **320** will finally be routed to the GGSN **324** in a network segment corresponding to the static IP address;

in step **302**, determining, by the GGSN **324**, that destination IP address of the downlink IP packet is the static IP address of the mobile terminal **320** based on local configuration information and the mobile terminal has no IP connection, querying for IMSI number of the mobile terminal based on the static IP address of the mobile terminal, and querying a HLR **326** for aSGSN **322** where the mobile terminal is located based on the IMSI number;

in step **303**, finding, by the HLR **326**, an address of the SGSN **322** where the mobile terminal **320** is currently located and returning it to the GGSN **324**;

in step **304**, sending, by the GGSN **324**, a downlink message notification to a given SGSN **322**;

in step **305**, returning, by the SGSN **322**, a message that the downlink message notification is received;

in step **306**, sending, by the SGSN **322**, a PDP context activation request to the mobile terminal **320**.

At the mobile terminal, it receives the request and starts a mobile terminal initiated PDP context activation procedure shown at step **307**.

It can be seen from the above steps that, network side initiated PDP context activation procedure needs a mobile

terminal to be bound with a fixed IP address, which wastes limited IP address and service cost is high.

In current instant message service, after a mobile terminal has logged into an instant message server, the instant message server generally only needs to record IP address and user ID, an instant message client of the mobile terminal keeps constant and fixed IP connection with the instant message server, the instant message client continually sends a heartbeat message to the instant message server, and the instant message server keeps the user in a logged-in state, such that the instant message client can continually send and receive instant message. Here, the mobile terminal may still employ the manner of pushing platform mentioned above to reduce data flow.

Whereas in the present invention, since an instant message client of a mobile terminal needs to disconnect an IP network connection when it is inactive and when there is no other network application program that is currently running, and the instant message server is required to, upon receiving a message for the instant message client, notify a mobile network through an interface provided by mobile network to wake up the mobile terminal so as to make the mobile terminal automatically re-establish network connection, corresponding changes need to be made on internal flow for the mobile terminal, the instant message server and the mobile network.

First, change on instant message server side is considered. A mobile terminal version instant message application program similar to push version instant message application program may be developed. FIG. **4** shows a diagram of a flow at instant message server side of a mobile terminal version instant message application. According to FIG. **4**,

in step **401**, storing a unique identification number of a mobile terminal **420** in response to login of an instant message client running on the mobile terminal. Within an instant message server **430**, IP address of the instant message client may be stored in association with user ID, and at this moment, the instant message client of the mobile terminal may utilize the instant message communication manner in prior art to communicate with other instant message clients;

in step **402**, modifying status of the instant message client as "saving mode" in response to receiving a request for transferring status of the instant message client into "saving mode". In case that IM user is idle for a long period of time, the user may choose to log off from the instant message server with a special reason; and the mobile terminal may disconnect IP connection if there is no other network application program that is currently running. Here, "saving mode" represents that an instant message client running on a mobile terminal has no IP connection. "Saving mode" is a special mode defined by the invention, in which the instant message server knows that the mobile terminal has no IP connection, but its IP connection can be activated at any time to access the instant message server so as to receive an instant message; after the instant message server receives "saving mode" status, it should not regard the client as offline due to the client does not send a heartbeat message.

in step **403**, sending a request for activating the mobile terminal **420** to a mobile application gateway **428** in response to receiving an instant message sent to the instant message client whose status is "saving mode", the request includes the unique identification number of the mobile terminal. Here, revised network side initiated PDP context activation flow is utilized to request the mobile network to activate the mobile terminal, so as to make the mobile terminal re-establish IP connection. The revised network side initiated PDP context activation flow will be explained in detail below.

in step **404**, sending the received instant message to the instant message client in response to the mobile terminal **420** re-logging into the instant message server **430** after being activated.

Then, change on mobile network side may be considered. At mobile network side, existing network side initiated PDP context activation procedure cannot be used, because that activation procedure needs a mobile terminal to use static IP. In an existing network side initiated PDP context activation procedure, since static IP address is used, the GGSN may store static IP address information subscribed by a mobile terminal in local configuration information, such that IMSI information of the mobile terminal can be found through the static IP address when receiving a data message intended to the mobile terminal. It is contemplated by the invention to use a revised network side initiated PDP context activation procedure, in which at network side, a mobile application gateway is used to directly communicate with SGSN rather than with GGSN. The reason is that, when a mobile terminal has not activated a PDP context, the GGSN does not have an inevitable relationship with the mobile terminal. During mobile terminal activation procedure, the SGSN may select different GGSN for activation based on factors such as whether current location of the mobile terminal is at home network or visited network, load condition of a GGSN, etc. The application gateway cannot determine with which GGSN it should communicate. However, current SGSN serving the mobile terminal can always be found through the HLR.

FIG. **5** shows a flow diagram of a revised network side initiated PDP context activation procedure according to the present invention, that is, a method of activating a mobile terminal from mobile network side, the revised network side initiated PDP context activation procedure mainly includes flows within a dashed block of the diagram. According to FIG. **5**,

in step **501**, receiving, by a mobile application gateway **528**, a request for activating a mobile terminal **520**, the mobile terminal has no IP connection, the request includes an unique identification number of the mobile terminal;

in step **502**, querying, by the mobile application gateway, a Home Location Register (HLR) **526** for address of a Servicing GPRS Supporting Node (SGSN) **522** where the mobile terminal is located by utilizing the unique identification number of the mobile terminal;

in step **503**, returning, by the HLR **526**, the queried address of SGSN **522** to the mobile application gateway **528**. In this query procedure, the HLR **526** needs to utilize the unique identification number of the mobile terminal.

in step **504**, sending, by the mobile application gateway **528**, the request for activating the mobile terminal **520** to the SGSN **522**. This step may be implemented in various ways. For example, a signaling message may be sent, or a Web Service may be provided on the SGSN **522** which is called by the mobile application gateway **528**; even an API may also be provided on the SGSN which is called by the mobile application gateway, and so on.

in step **505**, issuing, by the SGSN **522**, a request to the mobile terminal **520**, requiring the mobile terminal to issue a request for activating PDP context to the SGSN.

in step **506**, activating the PDP context for the mobile terminal **520** in response to receiving, by the SGSN **522**, the request for activating the PDP context issued by the mobile terminal.

FIG. **5** also shows, at step **507**, the interaction between a mobile terminal **520** and an instant message server **530** during a revised network side initiated PDP context activation procedure of the present invention. For the mobile terminal **520**,

FIG. **6** shows a diagram of a workflow corresponding to the mobile terminal. According to FIG. **6**, the flow comprises:

in step **601**, providing an user ID number of an instant message client and an unique identification number of a mobile terminal **620** upon logging into an instant message server **630**;

in step **602**, notifying the instant message server **620** of entering into "saving mode" and closing the instant message client in response to the instant message client being inactive for a period of time and it is confirmed that there is no other network application program that is currently running;

in step **603**, disconnecting IP connection in response to there is no other network application program that is currently running;

in step **604**, receiving a request, requiring the mobile terminal **620** to initiate a mobile terminal initiated PDP context activation procedure;

in step **605**, initiating the mobile terminal **620** initiated PDP context activation procedure toward the SGSN **622**/GGSN of the mobile network to acquire an IP address;

in step **606**, logging into the instant message server **630**, thereby acquiring the instant message sent to it.

Any detailed step of the mobile terminal in FIG. **6** has already been realized in prior art, the main purpose of providing such steps is to, in conjunction with FIG. **4** and FIG. **5**, make a reader has a comprehensive impression on the flow of the invention.

Under a same inventive conception, the present invention also discloses a mobile application gateway system, FIG. **7** shows a structural block diagram of the mobile application gateway system, according to FIG. **7**, the system comprises:

a request receiving module **701** configured to receive a request for activating a mobile terminal, the request includes an unique identification number of the mobile terminal;

a query sending module **702** configured to query a Home Location Register (HLR) for address of a SGSN where the mobile terminal is located by utilizing the unique identification number of the mobile terminal;

a query receiving module **703** configured to receive address of the SGSN queried by the HLR; and

an activation request sending module **704** configured to send the request for activating the mobile terminal to the SGSN.

In an embodiment, the query sending module is realized through one of the following manners: sending a signaling message to the HLR; calling a Web Service provided on the HLR; or calling an API provided on the HLR. Furthermore, in an embodiment, the request for activating the mobile terminal received by the request receiving module is issued by an instant message server.

Under a similar inventive concept, the present invention also discloses an instant message server, FIG. **8** shows a structural block diagram of the instant message server, according to FIG. **8**, the instant message server comprising:

a logging module **801** configured to store an unique identification number of a mobile terminal in response to receiving login of an instant message client running on the mobile terminal;

a status recording module **802** configured to modify status of the instant message client as "saving mode" in response to receiving a request for transferring status of the instant message client into "saving mode";

an activation request sending module **803** configured to send a request for activating the mobile terminal to a mobile application gateway in response to receiving an instant message sent to the instant message client whose status is "saving mode", the request includes the unique identification number of the mobile terminal.

In an embodiment, the instant message server further comprises: a message sending module **804** configured to send the received instant message to the instant message client in response to the mobile terminal re-logging into the instant message server after being activated.

Wherein, status of the instant message client being "saving mode" represents that the instant message client running on the mobile terminal has no IP connection, but its IP connection can be activated at any time to access the instant message server, so as to receive an instant message.

The "mobile terminal" in the invention refers to a device that can perform voice and data service through a wireless network, including handset, mobile computer with a SIM card, PAD with a SIM card, and so on.

The flowchart and block diagrams in the Figures illustrate the architecture, functionality, and operation of possible implementations of systems, methods and computer program products according to various embodiments of the present invention. In this regard, each block in the flowchart or block diagrams may represent a module, segment, or portion of code, which comprises one or more executable instructions for implementing the specified logical function(s). It should also be noted that, in some alternative implementations, the functions noted in the block may occur out of the order noted in the figures. For example, two blocks shown in succession may, in fact, be executed substantially concurrently, or the blocks may sometimes be executed in the reverse order, depending upon the functionality involved. It will also be noted that each block of the block diagrams and/or flowchart illustration, and combinations of blocks in the block diagrams and/or flowchart illustration, can be implemented by special purpose hardware-based systems that perform the specified functions or acts, or combinations of special purpose hardware and computer instructions.

The descriptions of the various embodiments of the present invention have been presented for purposes of illustration, but are not intended to be exhaustive or limited to the embodiments disclosed. Many modifications and variations will be apparent to those of ordinary skill in the art without departing from the scope and spirit of the described embodiments. The terminology used herein was chosen to best explain the principles of the embodiments, the practical application or technical improvement over technologies found in the marketplace, or to enable others of ordinary skill in the art to understand the embodiments disclosed herein.

What is claimed is:

1. A method of supporting instant messaging for a mobile terminal, comprising:

receiving, by a mobile application gateway for a packet domain core network which services a plurality of mobile terminals, a request for activating a first mobile terminal of the plurality of mobile terminals to receive a first communication from an instant message server, wherein the first mobile terminal has no IP connection and no static IP address associated with the first mobile terminal, wherein the request is received from the instant message server via an external packet switched network and includes an unique identification number of the first mobile terminal, and wherein the first mobile terminal is running an instant message client requiring continuous availability to receive communications from said instant message server via said external packet switched network;

querying, by the mobile application gateway, a Home Location Register (HLR) for address of a Servicing GPRS Supporting Node (SGSN) where the first mobile terminal is located by utilizing the unique identification number of the first mobile terminal;

returning, by the HLR, the queried address of SGSN to the mobile application gateway;

sending, by the mobile application gateway, the request for activating the first mobile terminal to the SGSN;

issuing, by the SGSN, a request to the first mobile terminal, requiring the first mobile terminal to issue a request for activating a Packet Data Protocol (PDP) context to the SGSN;

activating the PDP context for the first mobile terminal in response to receiving, by the SGSN, the request for activating the PDP context issued by the first mobile terminal; and

forwarding said first communication from the instant message server to the first mobile terminal using the activated PDP context.

2. The method according to claim **1**, wherein the unique identification number of the first mobile terminal is one of Mobile Subscriber ISDN number (MSISDN number) and International Mobile Subscriber Identification number (IMSI number) of the first mobile terminal.

3. The method according to claim **1**, wherein the step of activating the PDP context for the first mobile terminal in response to receiving, by the SGSN, the request for activating the PDP context issued by the first mobile terminal comprises:

receiving, by the SGSN, the request for activating the PDP context issued by the first mobile terminal;

parsing out, by the SGSN, an address of a Gateway GPRS Supporting Node (GGSN) of the first mobile terminal based on information provided by the first mobile terminal in the request for activating the PDP context, and issuing a request for creating mobile terminal PDP context to the GGSN;

allocating, by the GGSN, a dynamic IP address for the first mobile terminal and returning a response for creating the PDP context to the SGSN; and

receiving, by the SGSN, the response of the GGSN for creating the PDP context and sending to the first mobile terminal an acceptance message of activating the PDP context.

4. The method according to claim **3**, wherein the acceptance message of activating the PDP context includes a dynamic IP address allocated for the first mobile terminal.

5. The method according to claim **1**, wherein the step of sending, by the mobile application gateway, the request for activating the first mobile terminal to the SGSN is realized through one of the following manners:

sending, by the mobile application gateway, a signaling message to the SGSN;

calling, by the mobile application gateway, a Web Service provided on the SGSN; or

calling, by the mobile application gateway, an API provided on the SGSN.

6. A mobile application gateway system for a packet domain core network, comprising:

at least one processor;

a memory communicatively coupled to the at least one processor and storing instructions executable on the at least one processor;

a request receiving module configured to receive a request for activating a first mobile terminal of a plurality of mobile terminals serviced by the mobile application gateway to receive a first communication from an instant message server, the mobile terminal having no IP connection and no static IP address associated with the mobile terminal, wherein the request is received from the instant message server via an external packet switched network and includes a unique identification number of the first mobile terminal, and wherein the first mobile terminal is running an application program client requiring continuous availability to receive communications from the instant message server via the external packed switched network;

a query sending module configured to query a Home Location Register (HLR) for address of a Servicing GPRS Supporting Node (SGSN) where the first mobile terminal is located by utilizing the unique identification number of the first mobile terminal;

a query receiving module configured to receive address of the Servicing GPRS Supporting Node (SGSN) queried by the HLR; and

an activation request sending module configured to send the request for activating the first mobile terminal to the SGSN, wherein responsive to the activation request the SGSN issues a request to the first mobile terminal requiring the first mobile terminal to issue a request for activating a Packet Data Protocol (PDP) context to the SGSN, and the SGSN activates the PDP context for the first mobile terminal responsive to receiving the request for activating a PDP context from the first mobile terminal;

wherein the mobile application gateway forwards said first communication from the instant message server to the first mobile terminal using the activated PDP context.

7. The mobile application gateway system according to claim **6**, wherein the unique identification number of the first mobile terminal is one of Mobile Subscriber ISDN number (MSISDN number) and International Mobile Subscriber Identification number (IMSI number) of that mobile terminal.

8. The mobile application gateway system according to claim **6**, wherein the activation request sending module is realized through one of the following manners:

sending a signaling message to the SGSN;

calling a Web Service provided on the SGSN; or

calling an API provided on the SGSN.

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